DICROCOELIID TREMATODES FROM AUSTRALIAN HOSTS

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Summary

ANGEL, L. MADELINE and PEARSON, J. C. (1977) Dicrocoeliid trematodes from Australian hosts. *Trans. R. Soc. S. Aust.* **101**(5), 115-132, 31 August, 1977.

Eleven species of dicrocoeliids belonging to five genera are described; nine are new. *Brachylecithum* comprises seven species (six of which are named) separated by size, width/length ratio, acetabulum position and egg size. *Skrjabinosomum* is represented by three species, two of which are named. *Lutztrema* and *Pancreatrema* have one new species each. *Proacetabulorchis dogieli* is recorded from Australia.

Introduction

Sandars (1958) described *Platynosomum australiense* (syn. *Zonorchis australiensis*) from Australian marsupials, and listed seven other dicrocoeliids recorded from Australian reptile and bird hosts. Of these, *Paradistomum crucifer* (Nicoll), originally described from *Delma fraseri*, has since been recorded from four other lizards (Angel & Mawson 1968). The only other dicrocoeliids recorded from Australia are *Platynotrema biliosum* Nicoll from *Burhinus magnirostris* (syn. *B. grallarius*) and *Threskiornis molucca* (syn. *Ibis molucca*), *P. jecoris* Nicoll from *B. magnirostris*, and *Athesmia* sp from *Rattus norvegicus* (Munday 1966).

We now add five new species of *Brachylecithum*, one unnamed *Brachylecithum* species, two new species and an unnamed species of *Skrjabinosomum*, a new species each of *Lutztrema* and *Pancreatrema* and *Proacetabulorchis dogieli* Belopolskaja & Bychovskaja-Pavlovskaja.

All of the hosts of trematodes recorded in this paper are native to Australia; only *Petrochelidon nigricans* is migratory, and *Ardea novaehollandiae*, though it has no regular migration, sometimes occurs outside Australia.

The food of the definitive hosts of *Brachylecithum* species is given as indications of the possible intermediate hosts. Information on food was obtained from Cleland (1910), Cleland, Maiden, Froggatt, Ferguson & Musson (1918), Leach (1958), and from dissection records of the Department of Zoology, University of Adelaide. Where the life cycles of dicrocoeliids are known, the first intermediate host is a terrestrial gastropod, and the second, an insect, arachnid or terrestrial isopod.

All drawings were done with the aid of a camera lucida. Where measurements are given, the mean is in brackets after the range.

Holotypes and paratypes are deposited in the South Australian Museum (SAM). Type material and slides of other specimens mentioned are deposited in the former University of Adelaide Helminthological Collection (now located in the South Australian Museum) and in the second author's collection. Additional measurements from the type and other hosts are available from the authors on request. Measurements of suckers are means.

LIST OF PARASITES, ARRANGED WITH THEIR HOSTS

Mammals.

Rattus fuscipes (Waterhouse). *Brachylecithum insulare* n.sp. *Hydromys chrysogaster* Geoffroy. *Brachylecithum hydromyos* n.sp.

Birds.

Ciconiiformes: Ardeidae.

Ardea novaehollandiae Latham. *Proacetabulorchis dogieli* Belopolskaja & Bychovskaja-Pavlovskaja.

Gruiformes: Turnicidae.

Turnix castanota (Gould). *Skrjabinosomum mawsoni* n.sp.

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Caprimulgiformes: Podargidae.
Podargus strigoides (Latham). *Brachylecithum podargi* n.sp.

Coraciiformes: Alcedinidae.
Dacelo novaeguineae (Hermann). *Brachylecithum dacelonis* n.sp.

Passeriformes: Hirundinidae.
Petrochelidon nigricans (Vieillot). *Brachylecithum parvum* (Johnston).

Passeriformes: Timaliidae.
Pomatostomus superciliosus (Vigors & Horsfield). *Skrjabinosomum pomatostomi* n.sp.

Passeriformes: Muscicapidae.
Microeca leucophaea (Latham). *Skrjabinosomum* sp.

Passeriformes: Meliphagidae.
Meliphaga ornata (Gould). *Pancreatrema meliphagae n.sp. Manorina flavigula* (Gould). *Skrjabinosomum mawsoni* n.sp.

Passeriformes: Cracticidae.
Cracticus torquatus (Latham). *Brachylecithum latius* n.sp. *Gymnorhina hpyoleuca* (Gould). *Brachylecithum latius* n.sp., *Brachylecithum* sp.

Passeriformes: Ptilonorhynchidae.
Ailuroedus crassirostris (Paykull). *Lutztrema ailuroedi* n.sp.

Passeriformes: Corvidae.
Corvus coronoides Vigors & Horsfield. *Brachylecithum latius* n.sp.
Corvus mellori Mathews. *Brachylecithum parvum* (Johnston).

Reptiles.
Amphibolurus fionni Proctor. *Brachylecithum insulare* n.sp.

BRACHYLECITHUM Shtrom

Denton (1945) stated that *Brachylecithum* spp. were very delicate worms that showed considerable morphological variation as a result of host, habitat, age and hereditary factors [sic] and because of different methods of handling. He also noted that essential taxonomic characters were lacking for many species which were inadequately described, or described from poor material. The genus then contained 35 species and subspecies. The number is now over eighty and the observations of Denton still apply. It seems certain that when a thorough revision is made many species will be found to be synonymous. In the meantime it is not possible to compare adequately the Australian species with all previously recorded species. We have compared our species with any which occur in birds of the same or closely related genera in other parts of the world. Since only three species have been recorded previously from mammals, we have compared *B. insulare* n.sp. and *B. hydromyos* n.sp. with all three.

Brachylecithum and *Lyperosomum* are very similar genera which have caused taxonomists confusion. From the diagnoses of Skrjabin & Evranova (1953) after Shtrom (1940) and of Yamaguti (1971), it seems that the only consistent character used to separate them is the vitellaria, consisting of a small number of large follicles, occupying a small part of the body length in *Brachylecithum*, and in *Lyperosomum* of numerous small follicles occupying a greater distance in relation to body length.

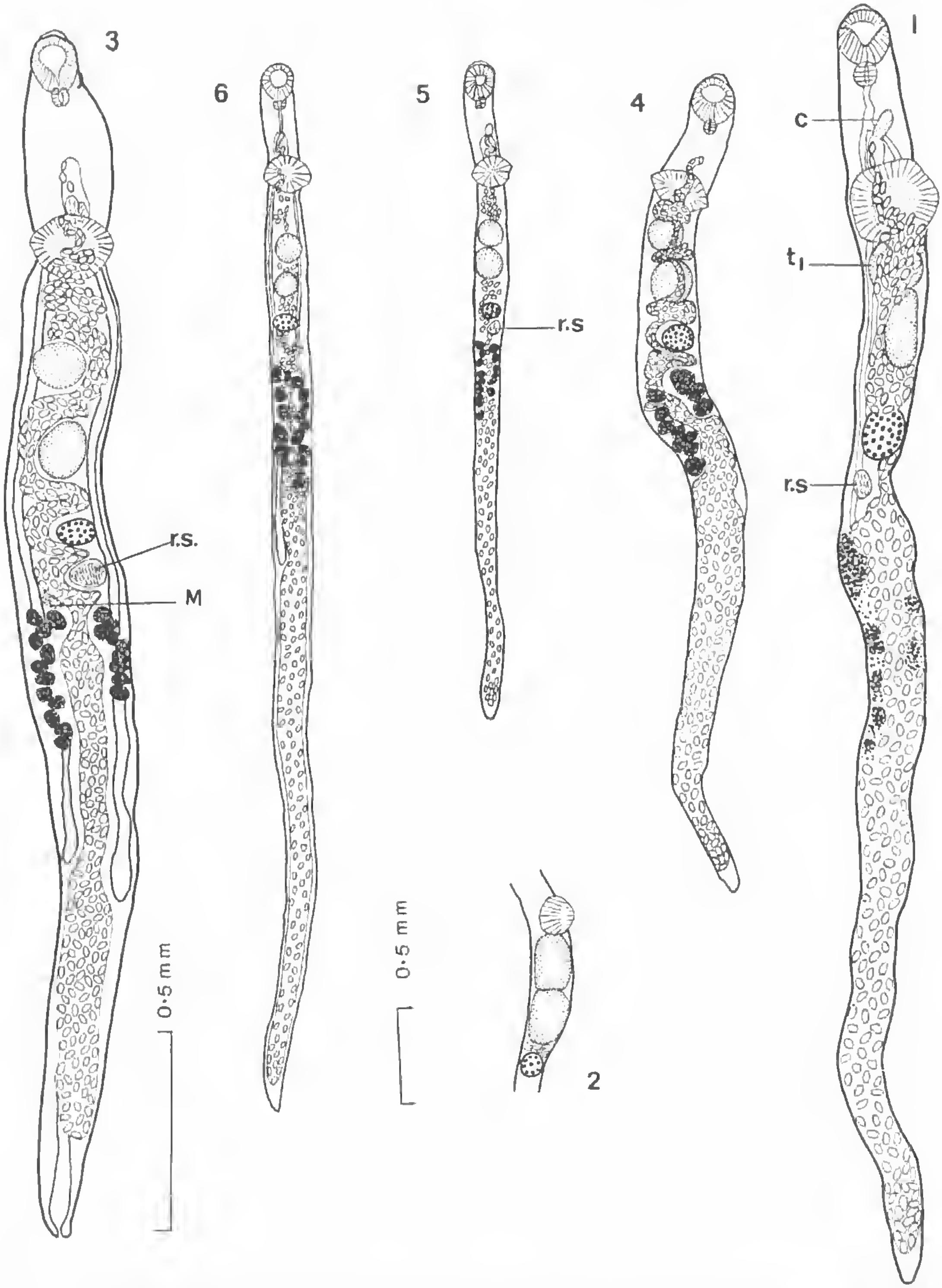
Yamaguti separated *Brachylecithum* into two subgenera, *Brachylecithum* and *Brachylecithoides* on the presence or absence of the uterus between the testes and between the testes and ovary. This is a character which varies in specimens from one host (compare Figs 1 and 2), so that we have not used it. Further, the size and even the shape of the testes and, to a lesser extent, of the ovary, vary from one specimen to another. Both characters may depend on the maturity of the trematode or on its state of extension when fixed.

Specific characters used are size, width/length ratio, position of acetabulum, presence or absence of papillae on surface of body, and size of eggs. In view of the variability of acetabular shape we have not considered it advisable to compare sucker ratios.

Key to Australian species of *Brachylecithum*

1. Width/length ratio of body greater than 1/9 .... *B. latius*
   Width/length ratio of body less than 1/9 2
2. Width/length ratio of body between 1/10 and 1/23 3
   Width/length ratio of body between 1/24 and 1/30 5
3. Acetabulum between anterior 1/4–1/5 of body; without papillae on body surface; eggs 36 x 20 µm .... *B. hydromyos*
   Acetabulum within anterior 1/5 of body 4
4. Acetabulum between anterior 1/5–1/6 of body; without papillae on body surface; eggs 43 x 22 µm .... *B. insulare*
   Acetabulum between anterior 1/6–1/7 of body; with papillae on body surface; eggs 39 x 23 µm .... *B. parvum*
5. Acetabulum between anterior 1/4–1/6 of body; with papillae on body surface; eggs 39 x 24 µm .... *B. dacelonis*
   Acetabulum between anterior 1/7–1/10 of body; without papillae on body surface; eggs 47 x 24 µm .... *B. podargi*

Characters from the type host in all cases.



Figs 1–6. 1. *Brachylecithum insulare* Holotype; 2. *B. insulare* Paratype SAM V77; arrangement of testes and ovary in specimen with comparatively few eggs; 3. *B. hydromyos* Holotype; 4. *B. parvum* from *Petrochelidon nigricans;* 5. *B. dacelonis* Holotype; 6. *B. podargi* Holotype (Figs 1 and 3 to same scale; Figs 2. 4-6 to same scale). ABBREVIATIONS: a, acetabulum; c, cirrus; e.b, excretory bladder; i, intestinal caecum; M, Mehlis' gland; o, ovary; oo, ootype; r.s, receptaculum seminis; t, testis; t1, t2, anterior, posterior testis.

The eggs measured in this study have been the largest mature specimens from balsam mounts. For eggs of *Brachylecithum parvum* (Johnston), Johnston's measurements are used, as the eggs in his slides are now unsuitable for accurate measurement.

Generic diagnosis: *Dicrocoeliidae, Dicrocoeliinae.* Body slender, filiform or lanceolate, flat or cylindrical; maximum width/length ratio not less than 1:45; with pre-oral lobe. Body surface with or without spines or papillae. Suckers usually subequal, not far apart. Caeca not reaching to hind end of body. Testes tandem or sometimes diagonal, contiguous or separate, immediately or a little posterior to acetabulum, occasionally underlying latter. Cirrus pouch pre-acetabular. Ovary round or oval, slightly behind testes. Vitellaria post-ovarian, commencing near ovary, limited in extent, consisting of small number of large follicles.

Parasitic in liver, gall bladder, pancreas or intestine of birds, mammals and reptiles.

Only three species of *Brachylecithum* have been described previously from Australia (Johnston 1917). Johnston assigned them to *Lyperosomum*, but Skrjabin & Evranova (1953) and Yamaguti (1971) placed all three in *Brachylecithum*. The species are *B. parvum* from *Strepera versicolor*, *B. megastomum* from *Sterna bergii* and *B. harrisoni* from *Ninox novaeseelandiae* (syn. *N. boobook*). We have examined the types of these species. In addition, in T. Harvey Johnston's collection is a slide of *B. parvum* and two of *B. megastomum* with S. J. Johnston's name, and other particulars on each showing them to be from S. J. Johnston's original material, as well as a mounted specimen complete, except for oral sucker and a small part of the anterior end, which bears a Zoological Laboratory, University of Sydney, label written in T. H. Johnston's hand "? *Lyperosomum*, Boobook owl". We have compared measurements of all of these, and find it impossible to differentiate between the three species. There is some variation between individuals of each species, such as the presence of coils of the uterus between the gonads. The specimen of *B. harrisoni* designated as type is incomplete and is in three pieces; the anterior end (oral sucker to begining of vitellaria) is not a good preparation, the gonads being largely, and the acetabulum partly, obscured by eggs. S. J. Johnston stated that *B. harrisoni* was closely related to *B. parvum*—"indeed, all three species are closely related to one another". With the material available to us, we hesitate to synonymise these three species.

Brachylecithum parvum (Johnston)

FIG. 4

Lyperosomum parvum Johnston, 1917, from *Strepera versicolor*, N.S.W.

Brachylecithum parvum: Skrjabin & Evranova, 1953.

Host. Petrochelidon nigricans.

Location in host. Liver and gall bladder.

Locality. Mannum, S. Aust., February 1972.

Incidence. 1 of 2 birds from same locality at same time.

Food of host includes insects.

Slides deposited. SAM V85, V86. Identification based on seven balsam mounts. Other specimens too twisted or broken to be of any use.

Host. Corvus mellori.

Location in host. Bile duct and/or gall bladder.

Locality. Tas., September 1969.

Incidence. 29 specimens, in one of 48 birds from Tas. (24 in July 1967, 24 in September 1969). In none of 9 *Corvus mellori* from S. Aust., 1966–1970.

Food of host includes insects.

Slides deposited. SAM V87, V88. Identification based on 10 balsam mounts.

Since *B. parvum* has priority in Johnston's (1917) paper, we have named the present species, *B. parvum*.

At first examination it appears that acetabulum shape might distinguish specimens from *Petrochelidon* and *Corvus*. Johnston described the suckers of *B. parvum* as "rather longer than broad". In a slide in T. H. Johnston's collection labelled "*Lyperosomum ?parvum, Strepera versicolor*", thought to be one of S. J. Johnston's preparations, the acetabulum measures 200 μm x 282 μm and shows, on one side, a lateral projection which is a feature in some of the species described here.

In each of four specimens from *Petrochelidon* in which both dimensions can be measured, the acetabulum is distinctly wider than long, and comes to a point on each side (Fig. 4). In 6 of 7 specimens from *Corvus mellori* the acetabulum is longer than broad; in the seventh, length and breadth are equal; in an eighth, mounted partly laterally, there are indications of the lateral projections. We conclude that acetabular shape is variable, depending perhaps on the muscular contraction of the organ, and also on the mounting of the specimen.

The type of *B. parvum* shows papillae on the surface of the body, which were not mentioned by Johnston. They are pointed or (mostly) rounded; about 13 μm across the base and 8 μm above the surface of the body. They may be present in the acetabular region, but occur only very occasionally anterior to it. Posterior to the acetabulum they are about 25 μm apart, in the vitelline region about 53 μm apart, diminishing to the posterior end.

Papillae similar in size and shape, and also limited to the acetabular and post-acetabular region, are present on the types of *B. megastomum* and *B. harrisoni*. They are present in some specimens from *Petrochelidon nigricans*, but not in the specimens from *Corvus mellori*, which are not so well preserved.

Petrochelidon nigricans, although migratory, breeds in Australia and is found in winter only in New Guinea and the southwest Pacific, from which areas *Brachylecithum* spp. have not been recorded. *Corvus mellori* is restricted to Australia.

Brachylecithum insulare n.sp.

FIGS 1–2

Hosts. *Rattus fuscipes* (type host), *Amphibolurus fionni*.

Location in host. Gall bladder and bile ducts.

Locality. Pearson Island, S. Aust.

Incidence. 1 of 4 rats (January 1969), 2 of 9 rats (February 1973); many trematodes in each infected rat. 2 of 11 lizards (January 1969).

Holotype. SAM V76.

Paratypes. SAM V77, V78, V79.

Other slides deposited. SAM V80, V81.

Pearson Island is remote and only occasionally visited by biologists. Some trematodes, fixed in the field by a colleague in 1969, were recorded as "elongate dicrocoeliids" from *Rattus fuscipes* and *Amphibolurus fionni* by Mawson (1971).

The following description is based on sections of 4 worms (1969, 1973) and on 9 whole specimens from *Rattus fuscipes* (collected in February, 1973 and frozen before dissection). The trematodes (including the holotype and paratypes) were stained in Ehrlich's haematoxylin and examined in cedarwood oil, and later made into permanent mounts. The measurements of these did not differ significantly from the measurements made in cedarwood oil.

Description

Body long, narrow, approximately cylindrical; mostly uniform throughout length, but occasionally wider; rounded anteriorly, slightly tapered posteriorly. Length, 2.8–3.6 mm; width or depth/length ratio 1:17–1:21 (1:19). (23 balsam mounts of trematodes fixed in the field in 1969 (on slides without pressure) measured 2.0–4.8 mm (2.92); the greatest width (0.36 mm) was in a specimen 2.24 mm long).

No papillae on body surface.

Acetabulum (198 x 208 μm) situated approximately in first fifth of body, larger than oral sucker (141 x 129 μm), wider than body. Ratio of width of oral sucker to width of acetabulum 1:1.5.

Pharynx almost spherical. Oesophagus and alimentary caeca poorly stained, indistinct. Oesophagus 45–110 μm long. Caeca 2, up to 26 μm wide, close to each other dorsal to acetabulum, then diverging laterally; terminating past the ovary, probably near posterior vitellaria.

Testes large, tandem, contiguous or nearly so; anterior testis close to or overlapping posterior border of acetabulum; shape often almost rectangular with rounded corners; posterior testis sometimes much elongated. Cirrus pouch arises dorsal to, and close to anterior border of, acetabulum; encloses coiled seminal vesicle. Pars prostatica absent. Cirrus muscular, about 24 μm wide, with rounded end, often protruding from genital pore, which lies medially, nearer to acetabulum than to pharynx.

Ovary rounded, entire. Receptaculum seminis large, longitudinally oval, close to posterior border of ovary. Laurer's canal not seen. Vitellaria forming approximately eight irregular lobes on both sides of body; limited to area posterior to ovary, extending to distance of 0.88–1.45 mm from end of body.

Uterus occupying all of body posterior to ovary, then passing anteriorly and dorsally, with a few coils between ovary and second testis, sometimes between testes and between first testis and acetabulum; opening at genital pore with male duct. Eggs numerous; brown; oval, often flattened along one side.

Excretory pore apparently terminal, with two wide arms extending well up length of body.

The specimens from *Amphibolurus fionni* differ from those from *Rattus fuscipes* in the relatively greater thickness and shorter length. The width/length ratio of 9 specimens from *R. fuscipes* averaged 1:19 and of 9 from *A. fionni* 1:13. However, a tenth from *A. fionni* measured 3.6 mm by 136 μm deep (1:26) i.e. almost as long as, and narrower than the longest of the 9 from *R. fuscipes*. The relationships and measurements of the organs do not appear to differ significantly. (Although the testes are in general smaller in specimens from *A. fionni* this is not regarded a significant character). Nearly all the specimens from *A. fionni* are lateral mounts, and the acetabulum could not be compared easily with that from the specimens from *R. fuscipes;* but in two spirit specimens from *A. fionni* the acetabulum was wider than the body, measuring 187 x 197 μm in the first, and 134 x 150 μm in the second. Twenty eggs from specimens from each of the two hosts averaged the same width (22 μm) but were 46 μm long in the specimens from *A. fionni* and 43 μm in those from *R. fuscipes*. Although it is possible (because of the differing width/length ratios) that the trematodes from the two hosts belong to distinct species, we assign the form from *A. fionni* to *Brachylecithum insulare*. The hosts live in close proximity on a small island. The snail host for the trematodes is not known, but it seems certain that ants act as second intermediate host for those from *A. fionni*. Smyth (1971) stated that *A. fionni* appeared to feed exclusively on small ants (*Iridomyrmex*). Although we have no information on the feeding habits of *R. fuscipes*, Smyth (pers. comm.) stated that ants are so numerous on Pearson Island he considered it impossible for any animal on the island to avoid ingesting them.

B. insulare is closely related to S. J. Johnston's three Australian species; the only features by which *B. insulare* can be distinguished are the size of the eggs (slightly longer and relatively narrower in *B. insulare*) and the absence of papillae on surface of body in *B. insulare*.

It is possible that life-history studies may be necessary to determine the relationship of these species. Two complete life-histories have been described—that of *B. americanum* Denton, which uses chrysomelid beetles as second intermediate hosts (Denton 1945), and that of *B. mosquense* (Skrjabin & Isaichikov), which uses ants (*Camponotus herculeanus*) (Carney 1967). Gabrion & Ormières (1973) reported metacercariae of *Brachylecithum* sp. in *Phalangium opilio* in France, but it seems unlikely that arachnids are involved in the life cycles of the four species here.

Of the bird hosts of *Brachylecithum parvum*, *B. megastomum* and *B. harrisoni*, *Strepera versicolor* is the only one known to eat ants, though it also includes beetles in its diet. *Sterna bergii* might be expected to feed exclusively on fish, but dissection records show that "beetle grubs" have been found in the stomach. *Ninox novaeseelandiae* eats beetles as well as other insects, spiders, etc., and could possibly ingest night-working ants (e.g. "meat ants" on carrion). We suggest that *B. megastomum* and *B. harrisoni* may use beetle larvae as second intermediate hosts, while *B. insulare* almost certainly uses ants. *B. parvum* could use either.

Brachylecithum has not previously been recorded from reptiles; only three species have been described from mammals, *B. aetechini* Dollfus from *Erinaceus algirus* from Morocco, *B. rodentini* Agapova, from *Clethrionomys rufocanus* from Kazakhstan and *B. taiwanense* Fischthal & Kuntz from *Hipposideras armiger terasensis* from Taiwan. A fourth, unnamed species was reported from *Blarina brevicauda* from N. Carolina by Miller, Price & Wilson (1974). *B. insulare* from *Rattus fuscipes* differs from *B. aetechini* in: smaller size (length, 2.0–4.8 mm in *B. insulare*, 4.6–6.0 mm in *B. aetechini*); ovary separated from second testis, while in *B. aetechini* the ovary is in contact, or almost, with this organ; testes in tandem, while in *B. aetechini* they are slightly diagonal; and in the egg length/breadth ratio, approximately 2:1 in *B. insulare*, 3:2 in *B. aetechini*.

B. insulare differs from *B. rodentini* (Agapova's paper not seen: data in Skrjabin (1970)) in its smaller size (length 2.0–4.8 mm in *B. insulare*, 5.0–6.5 mm in *B. rodentini*). It probably differs in width/length ratio, which was not given for *B. rodentini* but, from the measurements, appears to be from 1:10–1:12, and in *B. insulare* from *Rattus fuscipes* is 1:17–1:21. The acetabulum of *B. rodentini* is further forward; from the measurements, it lies in the anterior eighth to the anterior eleventh of the body, while in *B. insulare* it is in the anterior fifth. The vitelline fields are relatively smaller in *B. rodentini* and one side is said to be at a higher level than the other. Finally, the eggs are shorter in *B. rodentini* (36 x 23 μm), than in *B. insulare* (43 x 22 μm from *Rattus fuscipes*).

B. insulare differs from *B. taiwanense* (described from a single specimen) in: body shape (slightly tapered posteriorly in former, with rounded end in latter); width/length ratio, (1:19 in *B. insulare*, 1:13 in *B. taiwanense*); both suckers larger and oral sucker relatively smaller than acetabulum in *B. insulare* (oral sucker/acetabulum length ratio 1:1.4 in *B. insulare*, 1:1.14 in *B. taiwanense*, width ratio 1:1.6 in *B. insulare*, 1:1.45 in *B. taiwanense*); ovary shape, rounded in *B.*

insulare, much wider than long in *B. taiwanense*; and in its larger eggs (43 μm x 22 μm in *B. insulare*, 35 μm x 19 μm in *B. taiwanense*.

B. insulare is the only trematode found in *R. fuscipes* and *A. flavipes* from Pearson Island. The only other trematode found in a lizard from the island was *Paradistomum crucifer* (Nicoll), from the gall bladder of *Phyllodactylus marmoratus* (Mawson 1971). *B. insulare* was not found in other lizards examined, i.e. 6 *P. marmoratus* Gray, 5 *Lerista tetradactyla* (Lucas & Frost), 2 *Hemiergis peronii* (Fitzinger) and 1 *Morethia obscura* Storr (Mawson 1971).

Brachylecithum hydromyos n.sp.

FIG. 3

Host. *Hydromys chrysogaster*.

Locality. Lily Creek, Cairns, Qld, 14.ii.1975. (Coll. *C. M. Weaver*).

Location in host. Pancreatic ducts.

Incidence. More than 35 specimens in 1 of 3 rats from Cairns. In none of 49 hosts from S. Aust., or in two from Vict.

Food of host mostly fish, molluscs, crustaceans, but insect remains found in several rats.

Holotype. SAM V82.

Paratypes. SAM V83, V84.

The worms were recovered live, in good condition, and were in two distinct sizes, apparently representing different age groups. Of the 14 larger worms, only 4 were completely intact after removal. The description is based on whole mounts of these four and of six of the smaller (though egg-bearing) worms. Measurements given (range or means) are for the four larger specimens. The width/length ratio and the position of the acetabulum in relation to length of body, were similar in both sizes.

Description

Body sub-cylindrical, with prominent pre-oral lobe and acetabulum. Length, 1.8–3.4 mm. Greatest width from level of first testis to ovary; width/length ratio 1:12. (Depth approximately three-fifths width). Without papillae on body surface. Acetabulum (153 x 176 μm), aproximately in first fifth of body, rounded, with very slight projections on each side, protruding from body. Ratio of width of oral sucker to width of acetabulum approximately 1.0:1.4. Oral sucker (133 x 119 μm) rounded, pharynx slightly wider than long; oesophagus short, caeca passing almost immediately to sides of body; caeca obvious, up to 58 μm wide, terminating about 900 μm from end of body.

Testes rounded, in tandem or very slightly diagonal, separated from acetabulum and from each other by uterus. Cirrus pouch begins near antero-dorsal border of acetabulum. Genital pore in region of caecal bifurcation.

Ovary transversely oval; submedian, lying in first half of body. Receptaculum seminis large, with oval or irregular outline, up to 130 x 90 μm. Vitellaria consisting of 8–12 well-defined lobes (approximately 47 x 42 μm), in a compact row on each side of body, near sides of body. Uterus confined to inter-caecal area; posterior to caeca occupying all of body.

Excretory pore terminal: excretory bladder overlaps ends of caeca.

B. hydromyos differs from *B. insulare* from *Rattus fuscipes* in its relatively broader body, oval rather than rounded ovary, smaller and rounded testes; in the first testis being further separated from the acetabulum and the two testes always separated from each other; vitellaria much more prominent, not obscured by uterus and noticeably less in extent than in *B. insulare*; and in having smaller eggs (mean, 36 x 20 μm in *B. hydromyos*, 43 x 22 μm in *B. insulare*). The food of *Hydromys chrysogaster* (a water rat) and *Rattus fuscipes* is very different, and it is unlikely that *H. chrysogaster* would eat many ants.

B. hydromyos resembles *B. aetechini* in width/length ratio and in position of acetabulum, but differs from it in overall size, 1.8–3.4 mm (4.6–6.0 mm) and egg size, 36 x 20 μm (47 x 32 μm). *B. hydromyos* has a similar width/length ratio to *B. rodentini*, but is smaller, 1.8–3.4 mm (5.0–6.5 mm), and differs from the latter: in the more backward position of its acetabulum; in the testes being separated from the acetabulum and from each other (in *B. rodentini* the testes are almost contiguous and the anterior one underlies the posterior border of the acetabulum); the vitelline follicles are more, 8–12 (6–8), and the vitellaria and ovary are further back in the body. *B. hydromyos* resembles *B. taiwanense* in width/length ratio and position of acetabulum, but is apparently smaller, 1.8–3.4 mm for 10 specimens (3.6 for 1 specimen), its suckers are relatively smaller and the testes are separated from the acetabulum (but contiguous with it in *B. taiwanense*).

Brachylecithum dacelonis n.sp.

FIG. 5

Host. [1]*Dacelo novaeguineae.*

Location in host. Liver.

Locality. Bridgewater, S. Aust., July 1973.

Incidence. 1 of 9 birds from S. Aust.; none of 4 from N.S.W.; neither of 2 from Tas.

Food of host includes beetles, other insects, and spiders.

Holotype. SAM V89.

Paratypes. SAM V90, V91.

Description based on 10 balsam mounts of specimens recovered alive.

Description

Body slender, cylindrical, narrowing from ovary to posterior end. Length 2.9–3.5 mm, width or depth/length ratio 1:24–1:29 (1:26). Conical papillae (10 μm across base, 8 μm high, approximately 50 μm apart) on body surface from acetabulum to ovary, diminishing in number posteriorly. Acetabulum (176 x 152 μm) slightly larger than oral sucker (167 x 145 μm), situated approximately in anterior fifth of body, wider than long, with a blunt point on each side. Pharynx mostly wider than long, sometimes round; oesophagus bifurcating near genital pore; caeca end posterior to vitellaria, at about one quarter to one third of body length from posterior end.

Testes oval to rectangular with rounded corners, tandem, close together. Cirrus pouch arises between anterior edge and anterior third of acetabulum. Cirrus up to 80 μm long x 45 μm near base. Genital pore nearer to acetabulum than to oral sucker. Ovary round or slightly wider than long, median, close to second testis, in anterior two-fifths of body. Receptaculum seminis large, loosely coiled, about 105 x 65 μm. Vitellaria consisting of 7–11 compact follicles (up to 60 x 53 μm) on each side of body.

B. dacelonis is close to *B. parvum*, but differs primarily in width/length ratio. Both of Johnston's specimens of *B. parvum* are mounted on their sides, and the depth/length ratios (measured by us) are 1:12 and 1:20, whereas width/length ratio of 7 specimens of *B. dacelonis* is from 1:24–1:29. They are noticeably more slender worms than *B. parvum*. Corresponding with the lesser width in *B. dacelonis*, the suckers, pharynx and gonads are smaller than those of *B. parvum*.

Other species recorded from alcedine birds are: *B. halcyonis* (Yamaguti) from *Halcyon coromanda major* from Japan, *B. andamanensis* Soota, Srivastava & Ghosh (in Soota et al. 1973) from *Halcyon chloris* from the Andaman Islands, *B. palawanense* Fischthal & Kuntz from *H. chloris collaris* and *Ceyx rufidorfus rufidorfus* from the Philippines, and *B. sabahense* Fischthal & Kuntz from *H. chloris* from Sabah.

B. dacelonis differs from all of these in: narrower body (w/l ratio 1:24–1:29); (*B. halcyonis* (1:17–1:20) approaches this most nearly, the other three species are 1:10, 1:9–1:12, 1:8–1:9 respectively (our calculations)) and in size or relative dimensions of eggs (*B. dacelonis* 39 x 24 μm, *B. halcyonis* 42 x 21–22 μm, *B. andamanensis* 63–90 x 12–16 μm, *B. palawanense* 32 x 18 μm, *B. sabahense* 35 x 19 μm). It differs further: from *B. halcyonis* in its smaller size 2.9–3.5 mm (5.1–5.2 mm) and the acetabulum being further back, 1:4–1:6 body length (1:7) and from *B. sabahense* in lacking a constriction of the body at the acetabular level.

Brachylecithum podargi n.sp.

FIG. 6

Host. *Podargus strigoides.*

Location in host. Bile ducts.

Locality. Moggill, Qld, 26.v.1970. Brisbane, Qld, 6.xi.1962.

Incidence. 2 birds from Qld. None of 11 birds from S. Aust. and N.T.

Food of host includes beetles, other insects, and spiders.

Holotype. SAM V92.

Paratypes. SAM V93, V94, V95.

Description based on 10 balsam mounts of mature specimens from Moggill. Immature specimens from Brisbane were also examined.

Description

Body elongate, 4.3–5.8 mm; forebody slightly narrower than hindbody; hindbody fairly uniform in width to behind vitellaria, then narrowing gradually. Width or depth/length ratio 1:24–1:30 (1:28). Without papillae on body surface. Acetabulum (199 x 154 μm), approximately in anterior eighth of body, larger than oral sucker (172 x 155 μm), slightly wider than body, wider than long, sometimes coming to blunt point on each side. Pharynx almost spherical; oesophagus bifurcating about midway between suckers; caeca dorsal, ending near posterior border of vitellaria. (In 5.0 mm specimen caeca ending 2.4 mm and 2.6 mm from hind end of body).

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[1] Despite its specific name *D. novaeguineae* does not occur outside Australia.

Testes rounded, contiguous or not, slightly larger than ovary; anterior testis somewhat posterior to acetabulum. Cirrus pouch arises dorsal to anterior quarter of acetabulum; seminal vesicle coiled; genital pore midway between oral sucker and acetabulum, or slightly nearer to latter.

Ovary, close to or separated from posterior testis, situated in anterior two sevenths to one fifth of body. Receptaculum seminis large, post-ovarian. Vitellaria consisting of 7–13 follicles (up to 82 x 82 μm and 94 x 59 μm) on each side of body, post-ovarian. Uterus and male duct opening side by side at genital pore. Mean egg size 47 x 24 μm.

B. podargi differs from *B. dacelonis* in its greater size, the more anterior position of its acetabulum, and in the longer eggs. It differs from *B. harrisoni* (from *Ninox novaeseelandiae*, another night-flying bird, which may eat the same foods as *Podargus strigoides*) in the larger eggs, and the absence of papillae from the body surface.

The only *Brachylecithum* sp. previously recorded from the Caprimulgiformes is *Brachylecithum transversogenitalis sylvestris* Semenov from *Caprimulgus europaeus*. From the measurements and figure given by Skrjabin & Evranova (1953), this species differs from *B. podargi* in its shorter, much wider body (width/length ratio 1:8) and smaller eggs (26–33 x 16 μm).

Brachylecithum latius n.sp.

FIG. 11

Type host. Cracticus torquatus.

Location in host. Gall bladder.

Locality. Cowell, S. Aust., 27.v.1965.

Incidence. 1 of 5 birds from S. Aust.

Food of host includes beetles, ants and other insects.

Holotype. SAM V102.

Paratypes. SAM V103, V104, V105.

Other hosts. Corvus coronoides; liver; Port Augusta, S. Aust., 20.ix.1965, 1 of 4 birds from S. Aust. *Food* includes beetles and other insects. *Slide deposited* SAM V106. *Gymnorhina hypoleuca;* gall bladder; Adelaide suburb, S. Aust., 15.ii.1974, 1 of 68 birds from S. Aust., none of 16 from A.C.T. or 1 from N.T. *Slide deposited* SAM V107. *Food* of *G. hypoleuca* includes beetles, ants, other insects and spiders.

Description based on balsam mounts of 7 worms in quite good condition. Those from *Corvus coronoides* and *Gymnorhina hypoleuca* are also in good condition, but in the whole mounts the eggs are mostly filled with air, and are black.

Description

Body (3.5–6.5 x 0.54–1.26 mm) lanceolate, widest anteriorly, at level of first or second testis. No spines or papillae present on surface of body.

Acetabulum (447 x 588 μm) larger than oral sucker (259 x 259 μm), weakly muscular, wider than long, situated close to anterior end of body. Oral sucker rounded, well-developed. Pharynx rounded; oesophagus short, caeca two (only visible to level of mid-acetabulum).

Testes large, contiguous; roughly triangular, rectangular or oval; tandem to diagonal; anterior testis underlying posterior half of acetabulum. Cirrus pouch overlaps anterior part of acetabulum; cirrus 260 μm long, regular in width, 33 μm. Genital pore at caecal bifurcation, slightly nearer to acetabulum than to oral sucker.

Ovary oval with long axis across width of worm; generally contiguous with second testis, to right or left of body. Mehlis' gland posterior and oblique, to ovary. Receptaculum seminis not obvious. Vitellaria of quite large follicles, limited in extent, reaching anteriorly near level of ovary. Uterus very extensive, generally obscuring most of acetabulum and sometimes of vitellaria. Eggs approximately 47 x 31 μm.

The specimens from *Corvus coronoides* show some differences from those from the type host, probably attributable to immaturity. Thus, the uterus is less extensive, and does not so completely (if at all) obscure the acetabulum; the testes are in general smaller, do not underlie the acetabulum; and are always at least slightly diagonal. The acetabulum is further forward in worms from *Cracticus torquatus* than in those from *Corvus coronoides*, but the bodies of some of the worms are slightly contracted anteriorly. We consider that to use this character would involve comparing worms obtained alive and fixed under the same conditions. The acetabulum appears relatively greater in width in worms from the type host, but in the smallest (in which it is not obscured by eggs) it is 365 x 412 μm, conforming to the more nearly round shape in worms from *C. coronoides*. (In worms from *C. coronoides* the acetabulum comes to a blunt point on each side: a character obscured by eggs in worms from the type host. The size of the oral sucker may distinguish worms from the two hosts; but although the mean size of the organ in worms from *Cracticus torquatus* is 259 x 259 μm, in the largest worm from this host the oral sucker is 365 x 376 μm, in comparison with the largest, 388 x 353 μm, from *Corvus coronoides*. The eggs in worms from *Cracticus torquatus* are relatively wider than in those from *Corvus coronoides* and *Gymnorhina hypoleuca*, but this character is not sufficient to place the worms in separate species.

We have placed the species in *Brachylecithum* because it resembles this genus more than other related genera as defined by Yagamuti (1971). Although it resembles *Brachydistomum* in shape and some other respects, it is distinguished by the weakly developed acetabulum ("very prominent" in *Brachydistomum*).

Brachylecithum latius differs from congeners described here (including the unnamed species from the intestine of *Gymnorhina hypoleuca*) in body shape and width/length ratio (never more than 1:8.3 in *B. latius;* never less than 1:11 in the other species).

Of all described species of *Brachylecithum* (we have not seen the description of *B. riparia* Erkulov), *B. latius* most closely resembles *B. attenuatum parinum* Oshmarin from *Parus palustris,* Maritime Province, U.S.S.R. in shape and general appearance. However, it is larger (2.8 x 0.4 mm) and the eggs are smaller (reaching 58 x 29 μm in *B. attenuatum parinum*).

Brachylecithum sp.

Host. Gymnorhina hypoleuca.

Location in host. Intestine.

Locality. Encounter Bay, S. Aust. January, 1966.

Incidence. 1 of 68 *Gymnorhina* spp. from S. Aust.; none of 16 from A.C.T. or 1 from N.T.

Food of host includes beetles, ants, other insects, and spiders. Two slides (one of a single specimen in four pieces, a second with two whole worms and the anterior half of a third), University of Adelaide Helminthological Collection.

Two complete worms, one broken worm and the anterior half of a fourth were found. Although in poor condition, they were stained and mounted. Although the caeca are not visible the worms are referred to *Brachylecithum.*

Description

Long, narrow, cylindrical or sub-cylindrical worms (2.9–4.2 mm). Width/length ratio 1:21. No papillae seen on body surface. Not possible to measure testes and ovary but gonads apparently in tandem, situated quite close to acetabulum. Anterior margin of vitellaria 442 μm from acetabulum in each of 3 specimens. Vitellaria, about seven, generally compact, follicles (about 66 x 37 μm in size) on each side of body.

The condition of these worms does not allow a proper comparison with other species. It is probably close to *B. parvum,* the type host of which belongs to the same family as *Gymnorhina,* although it appears likely that the width/length ratio is less than in *B. parvum.* In a broken specimen the ratio of depth behind the acetabulum to the sum of the lengths of the four pieces was 1:35.

SKRJABINOSOMUM Evranova

Generic diagnosis: Dicrocoeliidae, Dicrocoeliinae. Body surface without papillae. Exceptionally long, slender; maximum width to length ratio not greater than 1:45. Pre-oral lobe; pharynx, short oesophagus, elongated caeca, posterior extent of which not traced. Acetabulum near to and larger than oral sucker. Testes elongate oval, separated from acetabulum, lying at end of anterior third or in middle third of body; in tandem, separated from each other and from ovary by uterus. Ovary round or oval. Vitellaria in post-ovarian lateral fields. Genital pore medial, pre-acetabular. Parasitic in liver, ?intestine of birds.

Skrjabinosomum differs from *Brachylecithum* in its greatly elongated narrow body, and displacement posteriorly of the reproductive organs from the acetabulum. *Brachylecithum lobatum* (Railliet) has the smallest width/length ratio known to us from previous descriptions of Dicrocoeliinae: 1:35–1:40, our calculations, from measurements given by Skrjabin & Evranova (1953). To separate the two genera, we have given the maximum width/length ratio of *Brachylecithum* as not less than, and of *Skrjabinosomum* as not greater than, 1:45. This figure may have to be adjusted in the future.

Skrjabinosomum mawsoni n.sp.

FIGS 7–9

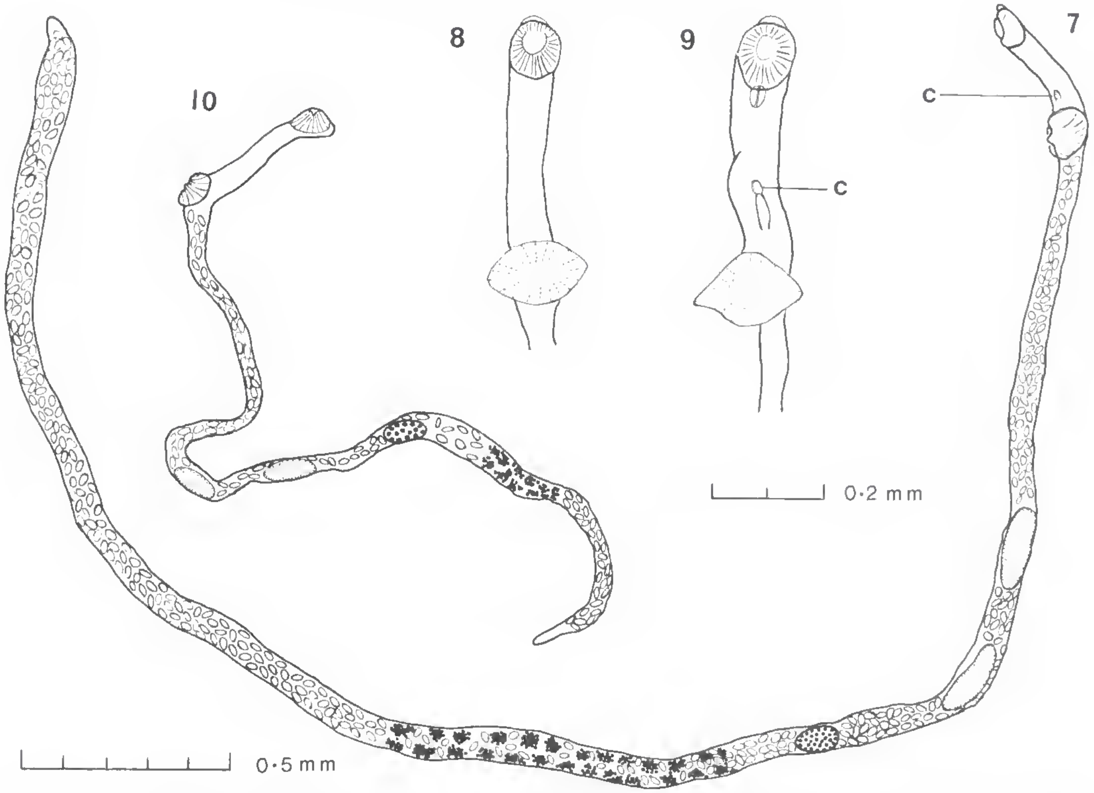
Type host. Manorina flavigula.

Location in host. Liver.

Locality. Port Augusta, S. Aust. May, 1965.

Incidence. 1 of 8 birds from S. Aust. and N.T. dissected 1965–1967.

Food of host includes beetles, ants and other insects.



Figs 7–10. 7. *Skrjabinosomum mawsoni* Holotype; 8. *S. mawsoni* Paratype; acetabulum; 9. *S. mawsoni* from *Turnix castanota;* acetabulum; 10. *S. pomatostomi* Holotype. (Figs 7, 10 to same scale; Figs 8, 9 to same scale).

Holotype. SAM V96 (lateral mount), with *paratype* (dorsal mount, complete but for oral sucker) on one slide.

Paratype. SAM V97.

Other slide deposited. SAM V98.

Other host. Turnix castanota. Cowell, S. Aust., 26.v.1965. In 1 of 2 birds collected together. (One complete; one complete except for first testis and anterior end; and four pieces). *From* liver. *Food of host* includes "heavy" insects.

Description based on whole mounts of 5 complete and 3 almost complete specimens, with 17 pieces of several other specimens from the type host.

Description

Body (4.0–5.4 mm) very long, narrow, cylindrical or sub-cylindrical. Width/length ratio 1:85-1:115 (1:102). Papillae not seen on surface of body. Acetabulum (131 x 129 μm), situated approximately in anterior twelfth of body, a little larger than oral sucker (103 x 89 μm); not strongly muscular, wider than body and approximately diamond-shaped; in lateral mounts margin folded irregularly. Oral sucker more muscular than acetabulum. Pharynx not clearly seen in most specimens; oesophagus and alimentary caeca not seen. (In specimen from *Turnix castanota,* pharynx obvious and part of oesophagus seen).

Testes elongate oval; situated well posterior to acetabulum; tandem. Cirrus pouch mostly anterior to acetabulum; cirrus with bluntly rounded end; genital pore nearer to acetabulum than to oral sucker. Ovary oval, smaller than testes. Ovary and testes more or less well separated from each other, probably depending on state of elongation of worm, by uterine coils. Vitellaria, beginning near posterior border of ovary, consisting of variously sized groups of small follicles; largely obscured by eggs; up to 800 μm in extent. Uterus, with many eggs, occupying all of hindbody not filled by gonads and vitellaria.

S. porrectum (Braun) from *Halcyon saurophaga,* New Guinea, and *S. elongatum* Yadav from *Sterna aurantia,* India, are the only species previously described in the genus. *S. mawsoni* shows a close resemblance to *S. por-*

rectum in general appearance, though it is much smaller. Travassos (1944) who reproduced Braun's (1902) measurements and figures, referred to the great elongation of the body of *S. porrectum*, and said that careful examination of Braun's figures gave a clear impression of material preserved in the early stages of decomposition. The widening of the body shown in the anterior third is almost certainly distorted. The length was 17 mm; maximum width was given as 0.57 mm (width/length ratio 1:30), width at posterior end 0.2 mm (1:85). From Travassos' fig. 3 we estimate the probable maximum width as 0.28 mm (ratio 1:60).

S. mawsoni differs from *S. porrectum* in: size (4–5 mm, 17 mm respectively); width/length ratio (1:85–115, 1:60); acetabulum not so near anterior end (forebody/total length ratio 1:12, 1:22); ovary (oval, spherical); testes further forward (in anterior third, middle third); eggs smaller (32 x 19 μm, 37–41 x 23 μm).

We have not seen the description of *S. elongatum*.

Skrjabinosomum pomatostomi n.sp.

FIG. 10

Host. *Pomatostomus superciliosus*.

Location in host. Liver.

Locality. The Bunkers, Flinders Ranges, S. Aust. 22.vii.1965.

Incidence. 1 of 35 birds, from S. Aust. and N.T., 1938–1969 (10 of which were from the Bunkers, July, 1965).

Food of host includes beetles and other insects.

Holotype. SAM V99, with six pieces of *paratype* on same slide. Two other slides, one with two twisted specimens and several pieces of no value (paratype SAM V100) the other with only anterior end (paratype SAM V101).

One entire trematode and a number of pieces of at least three others were recovered. All specimens were rather sticky. SAM V101 (anterior end only) was studied first in glycerine. Thus measurements of the suckers from the ventral and lateral aspect were taken. Description based on all available material.

Description

Body elongate (2.4 mm), narrowly cylindrical or sub-cylindrical, with pre-oral lobe. Papillae not seen on surface of body. Acetabulum (115 x 181 μm) not strongly muscular, diamond-shaped and transversely elongate in ventral view, probably a little larger than oral sucker (97 x 94 μm), lying between anterior sixth and seventh of body in holotype. Pharynx present; oesophagus and alimentary caeca not seen. Testes oval, situated well back from acetabulum, in tandem. Testes and ovary separated from each other by uterus. Ovary closer to posterior end of body than to acetabulum. Vitellaria not in well-defined follicles.

In *S. pomatostomi* the sizes of the organs and the distance of the acetabulum from the anterior end of the body, the distance of the first testis from the acetabulum, and the relationship of testes, ovary and vitellaria to each other are similar to these features in *S. mawsoni*. However, the much shorter distance from the ovary to the hind end of the body in *S. pomatostomi* makes the relative positions of the organs in body length distinctly different in the two species. In the five complete specimens of *S. mawsoni* from *Manorina flavigula* the ratio of length of body posterior to ovary to total body length is 10:17, 18, 18, 19 and 19; in a sixth specimen, the length of which can be estimated closely (lacking only the oral sucker), the ratio is 10:20; in the only complete specimen from *Turnix castanota* the ratio is 10:21. In *S. pomatostomi* it is 10:30.

Corresponding with the shortening of the hindbody in *S. pomatostomi* the acetabulum lies relatively further back, the vitellaria are shorter and nearer to the posterior end of the body, and the uterus and number of eggs are much reduced.

It appears that the acetabulum of *S. pomatostomi* is larger than that of *S. mawsoni* from *Manorina flavigula* (though the same size as in *S. mawsoni* from *Turnix castanota*). However, the acetabulum in both species is not strongly muscular and its outline is variable (probably depending on the position in which it is mounted). The natural shape of the acetabulum appears to be angular, with the margin coming to a point on each side of the body. When such a specimen can be measured in this position its width is maximal. The depth is probably a better indication of the size of the acetabulum. The width of the eggs (31 x 16 μm) is less in *S. pomatostomi* than in *S. mawsoni*.

It is possible that *S. pomatostomi* is a young form of *S. mawsoni* in which the hind end of the body has not reached its full length, the uterus and the vitellaria being not yet fully developed. But although the proportions of this part of the body are so markedly different, the size of the gonads (and presumably their maturity) is much the same in the worms from the two hosts. We regard *S. pomatostomi* a distinct species, characterised by the close proximity of the ovary to the hind end of the body.

S. pomatostomi differs from *S. porrectum* in size (2.4 mm, 17 mm respectively); in the more backward position of the acetabulum (forebody/hindbody 1:6–7, 1:22), in having an oval ovary, situated at 2/3 of body length (round, at midlength in *S. porrectum*), and in egg size (31 x 16 μm, 37–41 x 23 μm).

Skrjabinosomum sp.

Host. Microeca leucophaea.
Location in host. Liver.
Locality. Port Augusta, S. Aust, September, 1965.
Incidence. 1 of 11 birds from various localities (3 near Port Augusta) in S. Aust. and N.T., 1958–65.
Food of host includes beetles and other insects. Slide (with 5 pieces) deposited in University of Adelaide Helminthological Collection.

Five pieces of a very long, narrow trematode were stained and mounted on one slide. The worm was incomplete, and lacked hind end and oral sucker. The acetabulum, mounted in lateral view, is 76 μm high by about 39 μm deep. The testes are obviously situated well posterior to the acetabulum. Vitellaria show in two pieces; they consist of small follicles in large groups, not sharply demarcated, and occupy a length of at least 506 μm. Ten eggs measure 28–33 μm x 13–18 μm (30 x 14 μm).

The worm is similar to the elongate species *S. mawsoni* and *S. pomatostomi* and may be conspecific with one of them.

LUTZTREMA Travassos

Generic diagnosis. Dicrocoeliidae, Dicrocoeliinae. Body elongate or relatively broad, with pre-oral lobe. Body surface with or without papillae or spines. Acetabulum larger than oral sucker or suckers sometimes equal. Single caecum, or with one of caeca rudimentary and not extending beyond acetabulum; caecum relatively long, median, in form of zigzag. Genital pore about half-way between suckers. Testes post-acetabular or almost acetabular, tandem or diagonal. Ovary post-testicular. Vitelline follicles large, post-ovarian, lateral, sometimes converging anteriorly. Uterus occupying most of hindbody, with coils between ovary and testes. Parasitic in liver and gall bladder of birds and mammals.

Lutztrema ailuroedi n.sp.

FIGS 12–14

Host. Ailuroedus crassirostris.
Locality. Mt Glorious, Qld, 16.i.1957, 30.i.1957 (collected *K. E. Webber*), 29.x.1962.
Location in host. Bile duct and at mouth of gall bladder.
Incidence. From 7 to many specimens, in all 5 green catbirds examined.
Holotype. SAM V108.
Paratypes. SAM V109, V110, V111.

Description based on live worms and on balsam mounts of 8 whole worms and 3 anterior ends (16.i.1957). Measurements of worms from two collections, 29.x.1962 (2 birds) and 30.i.1957, with some additional information on these whole mounts.

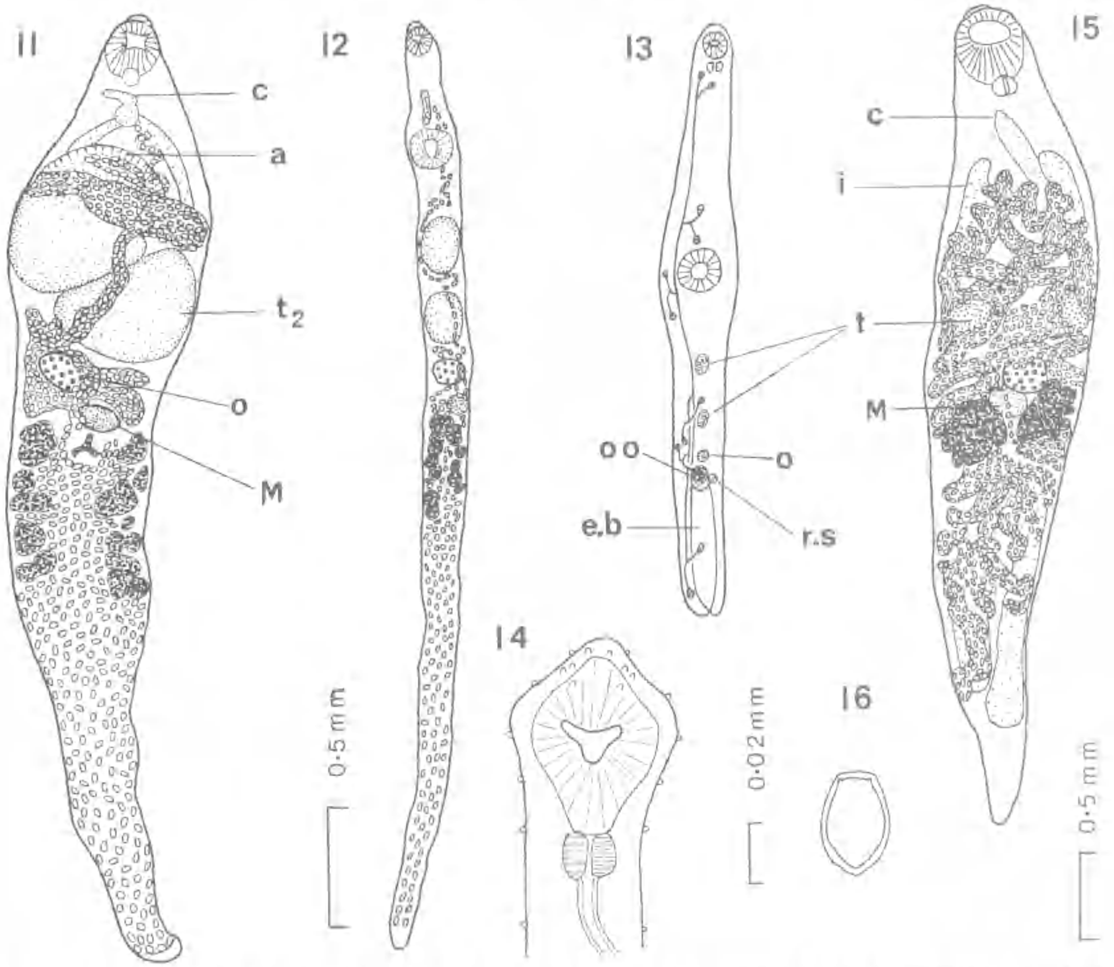
Description

Body elongate, almost cylindrical; forebody much narrower, bent back dorsally from protruding acetabulum; in whole mounts width generally slightly greater at level of vitellaria. Length 3.30–4.28 mm (3.80), width 0.221–0.272 mm (0.238) for 5 worms, depth 0.214 mm for 3 worms. Ratio of width to length 1:14–1:18. (In 2 hosts collected 29.x.1962, 8 mature trematodes measure 2.89–4.18 mm (3.30), and in one host collected 30.i.1957, 7 worms are 2.10–2.92 mm (2.60). Papillae scattered over length of body; most numerous on preoral lobe.

Suckers forming deep cups. Acetabulum larger than oral sucker, in anterior seventh to anterior fifth of body; 141–200 μm (176) long x 153–188 μm (172) wide, and (in 3 specimens) 165–200 μm (188) deep. Oral sucker 106–129 μm (114) long x 94–100 μm (96) wide, and (in 3 specimens) 94 μm deep. Sucker ratio (using mean diameters of length and width, in five specimens) 1:1.5–1:1.7). Pharynx 39–50 μm (47) x 53–63 μm (57) and (3 specimens) 55–60 μm (59) deep. Caecum dorsal to cirrus sac and to middle or side of acetabulum, sinuous dorsal to and between testes, dorsal to ovary and excretory bladder, ending less than half way from ovary to posterior end.

Excretory pore terminal. Excretory bladder I- shaped, in young specimens reaching nearly to ootype; common collecting tubules arising from anterior end of bladder; at level between testes giving off anterior and posterior collecting tubules. Excretory formula $2[(2 + 2 + 2) + (2 + 2 + 2)]$.

Testes tandem, round to elongate oval, 153–235 μm (191) long x 129–188 μm (162) wide, and (in 3 specimens) 141–153 μm (149) deep. Anterior testis separated from acetabulum by 119–306 μm. Testes contiguous or up to 85 μm apart. Seminal vesicle coiled. Cirrus sac



Figs 11–16. 11. *Brachylecithum latius* Holotype, dorsal view; 12. *Lutztrema ailuroedi* Holotype; 13. *L. ailuroedi* Sketch, of young specimen; 14. *L. ailuroedi* Sketch, anterior end showing papillae; 15. *Pancreatrema meliphagae* Holotype; 16. *P. meliphagae* Egg. (Figs 11, 15 to same scale.)

immediately anterior to acetabulum, about 158 x 53 μm. Genital pore about midway between suckers.

Ovary in anterior third to two-fifths of body, submedian, round or transversely oval, 88–118 μm (102) x 112–141 μm (129) and 106–123 μm (118) deep; separated from posterior testis by 34–136 μm. Receptaculum seminis up to 79 x 68 μm. Vitellaria composed of 8–10 large (up to 121 x 60 μm) follicles on each side of body. Vitelline fields 318–447 μm (376) long, from 34–136 μm posterior to ovary. Uterus occupying all of hindbody posterior to vitellaria, then passing forwards dorsal to and between ovary and posterior testis, posterior and anterior testes, anterior testis and acetabulum; travelling dorsal to cirrus sac and opening immediately anterior to cirrus at genital pore. Eggs 32–39 μm (35) by 21–23 μm (22); when new laid hatching in water; miracidium swimming actively.

The character which distinguishes *Lutztrema* from the closely related genera *Brachylecithum* and *Lyperosomum* is the alimentary system, in which there is a single caecum, or with one of the two caeca rudimentary; the main caecum is relatively long, median and in the form of a zigzag. Probably because the alimentary system was not described in the original descriptions, a number of species ascribed to *Lutztrema* have subsequently been referred to other genera (generally to *Brachylecithum*). Yamaguti (1971) listed 11 species from birds and one from a mammal; he did not mention the species *L. heterocaraxi* Bisseru, *L. singhi* Bano, *L.*

stunkardi Bano or *L. vitelloconfluentum* Ali, Deshmukh & Karyakarte. No further species have been described to date. Most of the above 16 species have relatively broad bodies, short behind the vitellaria, and *L. ailuroedi* differs from them in this and in other features. Its body width/length ratio is closest to that of *L. microstomum* Denton & Byrd (from *Cyanocitta cristata* Linn.), *L. singhi* Bano (from *Corvus splendens* (Kreillot)) and *L. heterocoraxi* Bisseru (from *Heterocorax capensis capensis* Sharpe). From the ranges of width and length given for the first two species, we estimate the width/length ratio of *L. microstomum* to vary from 1:11–1:16, and of *L. singhi* from 1:10–1:13. The measurements given of one specimen of *L. heterocoraxi* (presumably the holotype) show a ratio of 1:16.

The most notable difference between *L. ailuroedi* and *L. microstomum* is in the position of the acetabulum (situated "about one-tenth of body length from anterior end" in *L. microstomum*, and between the anterior seventh and fifth in *L. ailuroedi*). Other differences are: the body behind the vitellaria (as shown in the figure) is relatively longer in *L. microstomum*; in *L. ailuroedi*, the testes are round or elongate oval and lie in tandem, while in *L. microstomum* they are rounded to transversely oval and situated slightly obliquely; in *L. microstomum* the ratio of the diameter of oral sucker to acetabulum is 1:1.75–1:2.80, but in *L. ailuroedi*, 1:1.5–1:1.7. The eggs of *L. microstomum* may be slightly shorter (29–35 μm long, 19–24 μm wide). Laurer's canal was not observed in *L. ailuroedi*, but with these exceptions, this species agrees very closely with the description of *L. microstomum*.

Apart from its relatively narrower body, *L. ailuroedi* differs from *L. singhi* in having scattered papillae on body surface (*L. singhi* is covered with minute spines); eggs (32–39 μm) are slightly longer (30–36 μm in *L. singhi*); vitellaria ending somewhat nearer hind end of body; testes in tandem (somewhat oblique in *L. singhi*). Bano gives the position of the acetabulum as "posterior region of anterior third of body", but from the figure of the type, it is in the anterior fifth (in *L. ailuroedi*, anterior seventh to fifth).

L. ailuroedi appears to be close to *L. heterocoraxi*, but differs chiefly in the sucker ratio (1:1.5–1:1.7 in former, 1:2 in latter) and in egg size (35 x 22 μm in former, 39 x 26 μm in latter). The absolute sizes of the suckers appear to be greater in *L. heterocoraxi*, the acetabulum is slightly further back (in anterior fifth of body in *L. heterocoraxi*, between anterior seventh and fifth in *L. ailuroedi*) and the maximum width of the body is at the acetabulum in *L. heterocoraxi*; at the vitellaria in *L. ailuroedi*.

PANCREATREMA Oshmarin

Generic diagnosis. Dicrocoeliidae. Body flattened fusiform, with pre-oral lobe. Oral sucker moderately large, acetabulum lacking. Pharynx, short oesophagus, two caeca. Testes small, rounded, symmetrical, pre-equatorial; genital pore post-pharyngeal or post-bifurcal. Ovary round, submedian, in equatorial region. Vitellaria forming rather compact clusters on each side, close to posterior border of ovary. Uterus extensive but not in the extremities of body.

Parasitic in bile or pancreatic ducts of birds.

Pancreatrema meliphagae n.sp.

FIGS 15–16

Host. *Meliphaga ornata*.

Locality. Blanchetown, S. Aust. April, 1965.

Location in host. "Probably from bile duct".

Incidence. 1 specimen from 1 of 8 birds.

Holotype. SAM V112.

Description of holotype.

Flattened fusiform worm, 4.35 x 0.85 mm. Greatest width just anterior to testes. Oral sucker 400 x 388 μm; pharynx 118 x 118 μm; oesophagus short; two caeca, apparently terminating near posterior end of body. Acetabulum not seen. Testes entire, pre-equatorial, symmetrical, partly obscured by uterus; right testis about 176 x 200 μm, left testis about 165 x 188 μm. Ovary round, entire, 235 μm in diameter, submedian, just pre-equatorial. Genital pore apparently nearer to pharynx than to caecal bifurcation. Vitellaria in compact clusters; on left side reaching mid-ovarian level, contiguous with ovary, on right side post-ovarian; left cluster 376 x 282 μm; right cluster 470 x 400 μm. Uterus extensive, but not obscuring most of organs. Eggs (Fig. 16) plump, somewhat flattened at opercular end with slight shoulders at rim of operculum, slightly pointed at other end; 34–36 μm x 19–22 μm (average of ten, 34 x 21 μm).

In another specimen of *Meliphaga ornata* (from Cowell, S. Aust. May, 1965), about 10 trematodes in very poor condition were recovered from the bile duct or liver. It is not possible to identify these specimens definitely, but it is thought likely that they belong to *Pancreatrema*. They appear to be similar to *P.*

meliphagae in size and shape, and the eggs have the characteristic appearance of those of *P. meliphagae*, though they are slightly larger (35–42 μm long x 22–26 μm wide (40 x 24 μm)). Six oral suckers, taking stain only faintly, measure 176–212 μm long x 176–235 μm wide (193 x 207 μm), and one pharynx measures 59 x 59 μm.

Pancreatrema disacetabulum Oshmarin from *Eurystomus orientalis* from Russia, including the Primorskii Krai, is the only previously described species, but Lalitha & Alwar (1960) recorded *Pancreatrema* sp. from *Anas boschas domesticus* in Madras.

P. meliphagae differs from *P. disacetabulum* in its more slender shape (width/length ratio 1:5 in former, 1:3 in latter) in the slightly more forward position of the ovary, in the apparently more forward position of the genital pore, and in the size of the eggs (34 x 21 μm in *P. meliphagae*, 62 x 42 μm in *P. disacetabulum*). The eggs, although more pointed at one end in *P. meliphagae*, have the same general appearance in the two species. Measurements of the organs are much the same, except that the largest vitelline field in *P. disacetabulum* is almost twice the length of that in *P. meliphagae*. *P. disacetabulum* was found in the pancreas of *Eurystomus orientalis*; *P. meliphagae* was thought to be from the bile duct of its host.

Proacetabulorchis dogieli Belopolskaja & Bychovskaja-Pavlovskaja

Host. *Ardea novaehollandiae*.
Localities. Brisbane, Qld, 1.ix.1965 (21 specimens). Deception Bay, Qld, 15.viii.1961 (1 specimen; collected *G. Monteith*).
Location in host. Bile ducts.
Incidence. 2 of 2 birds from Qld, none of 14 birds from S. Aust.
Slides deposited. SAM V113, V114.

Description based on 9 stained mounts and 9 specimens in glycerine. (Measurements from stained mounts). The specimen from Deception Bay is much larger than the others, and measurements for it are given separately.

Description.

Body flat, elongate; width generally uniform, slightly greater behind acetabulum, generally behind mid-body. Length 3.4–4.2 mm (3.8), width 544–816 μm (646). Width/length ratio 1:4.8–1:6.9. On body surface, papillae, 18 μm across base, as close as 26 μm apart in preacetabular region, much sparser posteriorly (not apparent in all specimens). Suckers rounded, approximately equal. Oral sucker 329–435 μm (366) long x 294–388 μm (341) wide. Acetabulum, in anterior third of body, 318–412 μm (355) in diameter. Pharynx rounded, 94–112 μm (99) long x 88–118 μm (101) wide. Oesophagus, slightly contracted, 106–223 μm (141) long. Caeca extending to distance 510–816 μm (595) from end of body.

Excretory pore terminal; main stem of bladder bifurcating just posterior to ovary; excretory arms extending to level of pharynx.

Testes 94–212 μm (169) long x 118–247 μm (147) wide; contiguous, generally diagonal. (In 18 specimens, testes of 11 diagonal, 2 approaching tandem, 4 approaching symmetrical, 1 symmetrical). Anterior testis on right or left side; posterior testis slightly dorsal to anterior rim of acetabulum or slightly anterior to latter. Seminal vesicle internal; cirrus in one specimen 176 x 59 μm, with flattened end. Genital pore in region of caecal bifurcation, generally very slightly posterior to latter.

Ovary rounded, 71–153 μm (98) x 82–165 μm (109), median, near mid-length of body. Mehlis' gland somewhat diffuse, posterior and partly lateral to ovary. Receptaculum seminis large, rounded (in four specimens, 165–176 μm (174) x 141–164 (154)), abutting posterior lateral border of ovary.

Vitelline fields mostly extracaecal, from 680–1428 μm (1075) long, sometimes reaching acetabular level anteriorly; posteriorly reaching, approximately, posterior third of body. Follicles up to 82 x 33 μm, mostly in single or double row on each side.

Uterus intercaecal; posterior to caeca spreading out to sides and end of body. Ascending uterus passing dorsal to acetabulum and to testes, to genital pore. Eggs 29–32 μm (30) x 18–22 μm (20).

Specimen from Deception Bay: Length 7.2 mm, width 0.95 mm, width/length ratio 1:7.5. No papillae on surface. Oral sucker 447 x 494 μm, acetabulum 529 x 529 μm. Pharynx 141 x 129 μm, oesophagus 318 μm; caeca ending 1.19 mm from posterior end. Testes diagonal; anterior testis (on left), 517 x 270 μm; posterior, 435 x 282 μm. Cirrus 247 x 59 μm. Ovary 188 x 176 μm. Vitelline fields 2.18 and 2.07 mm, reaching to 2.21 mm from posterior end of body. Eggs 28–31 μm (30) x 17–20 μm (18).

Discussion

Three species have been assigned to the genus: *P. prashadi* Gogate, *P. dogieli* Belopolskaja & Bychovskaja-Pavlovskaja and *P. strigosus* Sudarikov & Pavlov but only *dogieli* agrees with Australian specimens in a sucker ratio approximately 1:1.

We have been unable to consult Belopolskaja and Bychovskaja-Pavlovskaja's description of *Proacetabulorchis dogieli*. Skrjabin (1970) (who followed Bychovskaja-Pavlovskaja (1962) in including the species in *Platynotrema* Nicoll) gave a figure, presumably from Belopolskaja and Bychovskaja-Pavlovskaja (1954), and a description of the species according to Belopolskaja (1954). We have compared our specimens with a further description by Bychovskaja-Pavlovskaja (1954) and with the figure and description in Skrjabin (1970), and conclude that they are conspecific. (Although in the figures given by these authors the vitelline fields appear to be shorter than in our specimens, in the measurements given in Skrjabin (1970) they are comparable with ours). Belopolskaja and Bychovskaja-Pavlovskaja's original specimens were from *Numenius arquatus* and *N. madagascariensis* from Siberia. Fischthal & Kuntz (1974) gave a description of *P. dogieli* from the mangrove heron, *Butorides striatus*, from Sabah, with a discussion of the species. They noted variation in the relative positions of the testes, which were somewhat diagonal in most of their specimens but were frequently symmetrical. As mentioned in our description, the testes in worms from one individual host varied from symmetrical to almost tandem.

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